**NSP**

# Taming the 'Monstropolous Beast': Combining models and public outreach for environmental risk management at Florida's Lake Okeechobee

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## Abstract

Since the mid-20th century, social scientists have highlighted ways in which tools of rationalization and technoscientific expertise obscure or erase subjectivity, moral decision-making and concerns about equity and inclusion. Such work points to a fundamental tension between rationality and democracy, namely, that rationalization tools and processes frequently limit what knowledge is recognized as valid, whereas democratic processes validate multiple knowledges and ways of knowing. In this paper, I analyze an attempt by the U.S. Army Corps of Engineers to combine rationalization (models) and democratization of expertise (public outreach) in the development of a manual for managing Lake Okeechobee, the heart of Florida's Everglades. Drawing on 13 interviews with agency staff and stakeholders, I first assess simplifications and subjectivities within the Corps' technical decision-making tools. I then describe how the Corps attempted to overcome these shortcomings and democratize decision-making through public engagement focused on achieving "balance" among multiple, sometimes competing needs and priorities. Building on work by standpoint theorists and scholars of science and technology studies (STS), I argue the Corps' efforts demonstrate how models and public engagement – rationality and democracy – may usefully be combined to increase equity, inclusion and transparency in managing anthropogenic environmental risks.

## Keywords

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# Introduction

Lake Okeechobee is the heart of the Everglades, the subtropical wetland that encompasses the southern third of Florida. Like blood through arteries, the lake's waters flow through low-lying sloughs, estuaries and manmade channels to the south, east and west. They hydrate sawgrass prairies and seagrass beds, nourish farmland, and help recharge the aquifer that provides drinking water to millions of South Floridians. The 730 square-mile lake thus is not only an ecological and geographic heart, but also an organ vital to the health of South Florida's human populations, wetlands and coastal biomes. Over the past 150-odd years, urbanization, development and agriculture have deeply entwined South Florida's human and non-human worlds with each other (Grunwald, 2006; Green, 2021). Consequently, Lake Okeechobee has become the heart of political and social struggles over the distribution of water.

In 1928, a massive hurricane swept a surge of water over the dike at the lake's south end, submerging farms and killing more than 2500 mostly Black sharecroppers (Brochu, 2003; U.S. Army Corps of Engineers, 2013)[1]. The consequences of this storm, as well as the devastating levee breaches in 2005 that followed Hurricane Katrina in New Orleans (Interviews: P1, P3, P5, P7, P11), reverberate in water management decision-making today. When subtropical summer deluges raise the lake's height above a certain threshold[2], federal water managers with the U.S. Army Corps of Engineers discharge lakewater to avoid a potential breach. The water runs east and west through estuaries—one natural, one man-made—toward communities on Florida's coasts.

From left to right: Historic water flows, present-day water flows and anticipated post-restoration water flows from Lake Okeechobee (Office of Everglades Restoration Initiatives, n.d.).

These discharges increasingly are harmful to the communities that receive them. Because of decades of pollution from fertilizer and leaking septic tanks, the lake water contains phosphorus and nitrogen. When these nutrients combine with the cyanobacteria present in many Florida waterways, they catalyze explosive growth of noxious, guacamole-thick blue-green algae that in recent summers has devastated coastal towns dependent on tourism and fishing. The Army Corps—the domestic and international public engineering service within the U.S. Army—thus is in the unenviable position of having to navigate a tradeoff between dike safety and algae bloom risk, with safety, health and welfare at stake for all communities involved.

The Lake Okeechobee System Operating Manual (LOSOM) will be the sixth manual the Army Corps has developed to guide how it handles this and other tradeoffs inherent in managing Lake Okeechobee (Gray, 2017). A notable catalyst for this new manual is the anticipated completion of repairs to the Herbert Hoover Dike at the lake's south end, which will provide an opportunity to reduce the volume of water discharged to Florida's coasts, and thus, to reduce algae bloom risk. This research explores the manual development process and how Corps staff engage stakeholders to determine what tradeoffs to make among the needs of different human communities, as well as between human communities and Everglades biomes. At stake is the well-being of the Everglades and those who rely on it for flood control, irrigation, drinking water, recreation, and living space. But also at stake is a new way of responding to anthropogenic environmental risks, one that strives for equity and inclusion, and legitimizes experience-based, non-technical

knowledge. The driving tension of these efforts is a paradox inherent in "democratizing expertise": If all perspectives are valid, but some of these perspectives conflict, by what process does a single, unified worldview emerge?

I begin by positioning this research in literature on the tensions between rationality and democracy, focusing on invisibilizations and shortcomings of rationalization processes, and whether democratization of expertise can help address these challenges. Next, I lay out the methodology I developed to ensure reflexivity and rigor in my research process. Then, I turn to the case. Drawing on interviews with Lake Okeechobee stakeholders and agency staff, I show how, by combining models and public outreach, the Army Corps built trust and facilitated stakeholders' understanding of the subjectivities and tradeoffs inherent in lake management. Acknowledging the partiality of the narrative I have developed, I conclude by highlighting lingering unease around the final lake schedule, and describing how this may encourage compromise, collective action and comprehensive ecosystem restoration.

## Literature Review

Ecosystem management is often discussed as an optimization problem (Rammel, et al., 2007; Levin and Xepapadeas, 2021), for which decision-makers attempt to use techniques of rationality (Koennig and Tummala, 1972; Rammel, et al., 2007) to achieve damage minimization, welfare maximization or some combination of the two, perhaps limited by incomplete or imperfect information (Courvisanos, 2009; Ross, et al., 2015; Simon, 1947, 1956) and social, ecological or political constraints (Levin and Xepapadeas, 2021). In ecosystem management, the question, "What do we do if we do not know what is best to do?" (Beckert, 1996: 819) is an astute one. Many economists, along with the sociologist Bruce Carruthers (2013), hold that in the face of uncertainty, decision-makers rely on "rationalization" – that is, they use quantification, probability estimates and other tools to shift from conditions of (incalculable) uncertainty to those of (calculable) risk, and then from risk to certainty. In contrast, Jens Beckert (1996) argues decision-makers rely on "social devices", including habits, traditions, conventions, organizational structures and power relations, to facilitate decision-making by restricting flexibility and limiting choice. My research concerns a situation in which decision-makers combine tools of quantification with social knowledge to develop an optimal management plan, and the tensions that result. In this literature review, I examine scholarship on the failures of rationalization and technoscience expertise as a basis for decision-making, then consider work on how to revitalize rationality with politics, context and complexity—qualities of democracy that rationalization tends to obfuscate.

### Rationalization and its discontents

Sociological treatments of processes of rationalization reveal that, in the quest for "objective" knowledge, the knowledge that is lost is at least as important as the knowledge that is found. Writing about commensuration, the process of transforming qualities into quantities, Nelson Espeland and Stevens (1998: 317) observe "Everyday experience, practical reasoning, and empathetic identification become increasingly irrelevant bases for judgment as context is stripped away and relationships become more abstractly represented by numbers." Empirical research has shown this to be true not only for commensuration, but for other techniques of rationalization, including classification and categorization (Cronon, 1991; Nelson Espeland, 1993), quantification (Nelson Espeland and Mennicken, 2019; Nelson Espeland, 1998), flood risk mapping (Elliott, 2019; 2021), and assigning of credit scores (Carruthers, 2013). What is lost may include acknowledgement of power disparities between stakeholders (Elliott, 2021), unquantifiable concerns and values (Nelson Espeland, 1998; Elliott, 2019); and transparency around moral decision-making processes that have significant implications for lives and livelihoods (Nelson Espeland, 1998; Elliott, 2021). These losses are particularly prevalent and acute for communities already marginalized by race, income level, age and gender, who may have few resources and little

power to contest their erasure (Jasanoff, 2003). Additionally, rationalization techniques often make risk appear to be natural rather than man-made (Koslov, 2019; Elliott, 2021; Gaul, 2019). This phenomenon is characteristic of Beck's "world risk society" (1999); in the case of environmental risk it is especially problematic because, in failing to acknowledge humans' role in risk-creation, we "leave ourselves little hope of discovering what an ethical, sustainable, honorable human place in nature might actually look like" (Cronon, 1996: 17, italics original).

Techniques and tools of rationalization are not the only causes of erasures. Scholars of global development, as well as science and technology studies, highlight the tendency of technical expertise to render problems "apolitical" (Ferguson, 1990; Porter, 1995; Li, 2007; Robbins, 2019; Mennicken and Nelson Espeland, 2019) in ways that often ultimately serve to uphold a painful status quo or generate new risks and losses (Ferguson, 1990; Beck, 1999; Li, 2007). This is a hallmark of the world risk society: the very experts purported to have solutions might intensify problems or create new ones (Beck, 1999; 2006; Tierney, 1999). The result is a feedback loop in which efforts to reduce risk are actually risk-generative; as Giddens (1994: 87) puts it, "[S]ince there are no super-experts to turn to, risk calculation has to include the risk of which experts are consulted, or whose authority is taken as binding." Among standpoint theorists such as Harding (1992) and Haraway (1988), this understanding motivates re-examinations of assemblages of "objective" rationality, including both human actors (scientists, other technoscience experts and bureaucrats) and non-human processes (scientific methodology, as well as quantification, classification, commensuration and other techniques of rationalization). In prying open black boxes of technocratic decision-making, standpoint theorists and STS scholars made clear that a marriage of democracy and technoscientific expertise was both desirable and necessary for more equitable outcomes. In Beck's words (1999: 22): "All manner of experts can never answer the question: how do we want to live?"

## Democratizing expertise: Premise and promise

The question of which experts are consulted, and who has binding authority, is a key preoccupation of scholars of the "third wave" of science and technology studies (Collins and Evans, 2002). Eyal (2013: 869), distinguishes between "experts" and "expertise", "experts" being actors who can claim jurisdiction over a task because of their (supposed) disinterestedness, skills and credibility; and "expertise" meaning the capacity to accomplish the task. Turner (2001) identifies five types of expertise that have varying degrees of authority, from expertise that is near-universal to expertise that is accepted only by smaller groups, sects, agencies or specialist consumers. Collins and Evans (2002) argue that expertise may be derived from experience, but that experience alone is not sufficient for expertise; also important is the capacity of different experts to interact with, and therefore contribute to, one another's work. They build on Wynne (1996), whose study of interactions between government scientists and Cumbrian sheep farmers revealed the existence of a divide between "expert" knowledge and "lay" knowledge, in which the "experts" were unwilling or unable to recognize the value of non-technical, uncertified expertise. Together, these scholars illustrate that people not recognized as "experts" often have knowledge that may be useful to the resolution of a problem, so in theory, expertise and democracy are not only compatible, but symbiotic. However, this work also raises "the problem of legitimacy" (Collins and Evans, 2002: 237), whereby political, institutional and cultural forces and structures tend to preclude lay knowledge or experience-based expertise from technical decision-making. The effect is a "rule of experts" (Mitchell, 2002), in which expert solutions often fail to address risks, and may in fact cause harm to lives and livelihoods (Ferguson, 1994; Mitchell, 2002; Li, 2007).

In response, Nowotny (2003) takes a normative approach, arguing for "socially robust knowledge" that has three characteristics. First, it must be tested for validity "outside the laboratory, in a world in which social, economic, cultural and political factors shape the products and processes resulting from scientific and technological innovation" (2003:

153). Second, it must include "an extended group of experts, of real or symbolic users and of real or 'imagined' lay persons" (2003: 154). Finally, it must remain "open to continuous social monitoring, testing and adaptations" (2003: 154). Meeting these three criteria could help ensure accountability (Nowotny, 2003; Jasanoff, 2003) and enhance justice for marginalized populations (Grove, et al., 2020). But questions remain. Does democratizing expertise mean all knowledge is expert? Who decides? (Collins and Evans, 2002) A few scenarios help to animate this problem. For instance: when deciding how to manage mildly radioactive grassland, ought Cumbrian sheep farmers with little formal training but extensive knowledge of local ecology be endowed with an amount of expert authority equalling that of government scientists? (Wynne, 1996; Collins and Evans, 2002) Or, when designing a citywide post-disaster recovery strategy, should low-income residents be invited to participate alongside development bureaucrats? (Gotham and Greenberg, 2008).

To address these types of questions, Collins and Evans (2002) say we must distinguish between expertise that has technoscientific relevance and expertise that has political and moral relevance; they further argue that multiple kinds of expertise may be relevant to technoscientific questions. Democratizing expertise thus implies not only bringing new knowledge and stakeholders to decision-making processes, but also opening for public debate questions of morality that processes of rationalization and technoscientific inquiry tend to obscure. The stakes of foregrounding these questions could not be higher. As Elliott (2021: 118) puts it, "The power to define risk is also the power to define responsibilities. Changing the parameters of how risk is assessed, modeled, mapped, and priced can change designations of who has the right, obligation, or ability to do something about hazards."

## Democratizing expertise: Perils in practice

The question that remains is whether rationalization and democratization of expertise are actually compatible in practice. Can diverse technical and non-technical stakeholders be brought together to make a decision? Can this be done in a way where experience-based expertise stands on par with technical expertise and tools of rationalization? Or—as work by Foucault (1978), Miller and Rose (1990), Nelson Espeland (1993) and Wynne (1996) seems to imply—will non-technical knowledge simply be subsumed by technocracy, as technical experts and processes of rationalization ignore, mischaracterize or fail to recognize the value of lay knowledge?

These questions are vital for a new wave of bureaucrats and technical experts who seek to make decision-making processes more inclusive, equitable and transparent in the face of political polarization and institutional path dependency (Nelson Espeland, 1998; Fitzgibbons and Mitchell, 2019). But—especially as a means of risk management—the potential compatibility of rationalization and democratization of expertise is understudied. While Jasanoff's "technologies of humility" (2003) and Nowotny's principles of "socially robust knowledge" (2003) provide useful considerations for risk managers hoping to take a democratic track, this work lacks empirical grounding to clarify what these considerations would look like in practice. Scholarship on public administration, meanwhile, contains a significant body of literature, both theoretical and empirical, focused on collaborative production of environmental governance strategies. However, this work is largely oriented toward conservation and sustainability issues rather than environmental risk management (see Wyborn, et al., 2019; van Kerkhoff and Lebel, 2015).

Empirical work by scholars including Kerr et al. (2007), Grove et al. (2020) and Elliott (2021) demonstrates some successes and shortcomings of technical experts' attempts to welcome lay knowledge into techno-science decision-making. Nelson Espeland (1993; 1998) looks at the extent to which bureaucratic and quasi-bureaucratic assemblages successfully use techniques of commensuration to include the knowledge of an Indigenous community into planning for a dam in Arizona. In work on "epistemic participation" (2013), Reichmann describes how technical experts "smooth away" discrepancies in non-technical knowledge to create a single, unified economic forecast; this is comparable to the

Army Corps' efforts to create a single, unified lake management plan that encompasses competing needs and contradictory priorities. However, the above work largely focuses on democratization efforts where laypeople participate in decision-making through qualitative channels and processes. It does not extensively examine the question of whether non-technical experts might effectively express their concerns and priorities quantitatively.

Against this backdrop, the case that follows is significant in two ways. First, the effort to develop an operating manual for Lake Okeechobee is in part an effort to manage multiple concurrent risks through the democratization of expertise. As mentioned, relatively little literature exists on democratization of expertise as a means of developing risk management strategies. But this is an important area of study, as communities (Fitzgibbons and Mitchell, 2019; Grove et al., 2020) and countries (Bulkeley, 2012) increasingly attempt to empower diverse stakeholders to co-create plans for managing anthropogenic environmental risks.

Second, the public outreach process for the Lake Okeechobee manual included opportunities for stakeholders to provide their knowledge through qualitative channels (stakeholder workshops), as well as quantitative ones (stakeholders could suggest changes to models and/or submit their own models for the Corps to review). With these efforts, the Army Corps sought not only to build trust in its process, but also to enhance stakeholders' understanding that tradeoffs among different communities are an inevitable part of any outcome. In other words, as part of work to co-develop a single, unified management plan, the Corps also encouraged stakeholders to recognize ways in which their priorities are at odds. This is a striking counterexample to the canon of literature (Ferguson, 1990; Porter, 1995; Li, 2007; Robbins, 2019; Mennicken and Nelson Espeland, 2019; Elliott, 2019, 2021) on how rationalization often serves to obscure tradeoffs and moral-decisionmaking, and render social problems "apolitical".

The driving questions of my research are as follows:

- How do efforts to develop a rational, "balanced" water management plan impose tradeoffs among different stakeholders? What is lost, and who loses it? Who "wins"?

- How do rationalization processes, namely, technical modeling and interactions among various types of experts, reflect moral decisions about what is "balanced" or "fair"?

- To what extent do efforts to democratize expertise help ensure losses and gains are distributed "fairly", or "balanced", among different stakeholders?

This research is rooted in concerns about erasures and injustices perpetrated by rationalization. But it also acknowledges that the experts ensconced in assemblages of decision-making are beginning to understand that technocracy has entrenched racism, classism, sexism, heteronormativity and environmental degradation. For those who believe the future of environmental risk management must entail valuing diverse – and sometimes conflicting – perspectives, I ask: (how) can it be done?

I decided to research Lake Okeechobee management after several years living and working in South Florida, first as an environmental journalist and then in local government. Bearing in mind my prior experience and pre-existing relationships with some of my research participants, near the beginning of my research process, I reviewed literature on researching as "the intimate insider" (Taylor, 2011), ethics beyond the institutional review board (Blee and Currier, 2011) and how to pursue "strong objectivity", that is, recognize positionality and privilege, and how dominant narratives might influence research findings (McCorkel and Myers, 2003). Based on this scholarship, I sought to develop a methodology that was reflexive as well as rigorous. Three times—when I developed my research questions, when I applied for institutional ethics review, and during my coding and analytical process—I reflected in writing on my position and motivations. Conducting this reflection encouraged me to seek out participants whom I believed might force me to re-examine the narrative I was developing (a process Burawoy (1998: 20) calls "theoretical reconstruction"); it also provided the basis of a researcher positionality statement I articulated to each participant prior to beginning the interview, toward ensuring they knew my position as much as I would come to know theirs. Further, as a way of challenging the potential preconceptions I brought with me to this project, I strove for systematicity in interviewing, coding and analysis.

## Methodology

Over approximately two months, I conducted 13 semi-structured interviews by Zoom or phone, each lasting 45-60 minutes in duration. I identified initial research participants through my prior knowledge of various stakeholder groups in and around the lake. I identified subsequent participants by attending virtual public stakeholder workshops hosted by the Army Corps, where I presented myself as a researcher and took down names of potential research participants, whom I later contacted via email or phone call to request an interview. Prior to the first interview, I developed a set of semi-universal interview questions on topics such as what participants felt was at stake in the planning process and what they believed the Corps meant by a "balanced" approach to water management; prior to every interview, I then tailored these questions (a) to each specific interviewee and the community or group they represented and (b) based on responses from other participants who had generated new lines of inquiry. I coded each transcribed interview, initially using start-codes drawn from the literature and from the interest areas I had identified in my questions, then expanding to include other themes that emerged inductively as I traversed participants' responses. Throughout this process, I generated several code memos (a la Emerson, et al., 2011: 172) on topics including fairness, balance, power and tradeoffs.

| RESEARCH PARTICIPANTS | |
|---|---|
| **Stakeholder Group/Area** | **Participant ID** |
| Environmental Nonprofit | P1, P3, P5 |
| West Coast Municipalities | P4, P7 |
| East Coast Municipalities | P6, P8 |
| Miccosukee Tribe of Indians of Florida | P2 |
| Seminole Tribe of Florida | P12 |
| U.S. Army Corps of Engineers | P9, P10, P11 |
| South Florida Water Management District | P13 |

It is important to note this research took place over a limited period of time—four months, from May to August—in the latter part of what is likely to be a four-year outreach and planning effort by the Corps. Moreover, this research does not include the perspectives of all the various stakeholder communities and agencies. Conspicuously absent are representatives of agricultural communities around Lake Okeechobee, with whom I was not able to secure interviews despite multiple attempts to contact several different potential participants. Also absent are representatives of South Florida and Florida Keys communities (many of whom have water supply concerns entwined with water management decisions farther north) as well as representatives of several state and federal agencies who participated in the stakeholder workshops. Were I to continue this research, I would prioritize speaking with these groups; I also would expand my engagement over a longer period of time. However, as Small (2009) and Baker and Edwards (2012) point out, qualitative research does not require a certain number of cases to say something meaningful. Drawing on their guidance, I sought a range of unique cases, and allowed each interview to inform questions I asked in subsequent ones until I felt I had reached saturation regarding my main area of inquiry. Ultimately, my analysis cannot speak to the specific concerns of every individual and community that has something at stake in the LOSOM development process. However, the 13 interviews I conducted are sufficient to develop a coherent, though partial and situated, account of the effort and its effects.

## Findings and Analysis

The primary finding of this research is that tools of rationalization (models) and expertise democratization (public outreach) may usefully be combined to increase the transparency and inclusiveness of efforts to manage anthropogenic environmental risks. I make my case by assessing the successes and shortcomings of the Army Corps' effort to engage stakeholders in navigating tradeoffs inherent in lake management. Before moving to this detailed analysis, it is important to note one overall success of the Corps' effort: it engendered trust in the modelling and manual development process, which previously was beleaguered by a lack of transparency and accusations of favoritism. Interviews with Lake Okeechobee stakeholders reveal that, although many expect to be less-than-perfectly satisfied with the final outcome of the manual development process, they also largely believe the Corps is making a good-faith effort to co-develop the lake management plan. Stakeholders commended the Corps for a manual development process that has been engaging (P1, P4, P12), fair (P3) or more fair than in the past (P8, P12), inclusive (P12), educational (P12) and "a really awesome step forward in the right direction" (P6).

This success notwithstanding, the Corps' use of quantitative models still obscures some non-quantifiable considerations, including subjectivity in modeling, and power differences among stakeholders. In the next section, I investigate stakeholders' awareness of these invisibilizations and assess the Corps' efforts to combat them. Then, I assess the manual development process against relevant literature on governmentality and expertise democratization; I argue that despite its shortcomings, the process shows how rationalization (models) and democratization (public outreach) may be combined to engage stakeholders in navigating the questions of "fairness" and "balance" inherent in risk management decision-making. Finally, acknowledging that this conclusion reflects situated, partial knowledge, and that it is the outcome of a research process that rationalizes democracy without providing for the reverse, I explain how lingering unease about the manual development process might catalyze compromise and collective action to reduce environmental risk tradeoffs.

## Invisibilizations of modeling

Literature on quantification has established the tendency of models to erase or obscure that which is unquantifiable: non-economic values (Elliott, 2019; 2021), power disparities (Nelson Espeland, 1993; 1998), and uncertainty and subjectivity within "objective" frameworks. Interviews reveal that as stakeholders participating in the Corps' public outreach process learned about (and in some cases, contributed to) the models' development, they developed a greater understanding of some of these invisibilizations. For instance, much of the data used as a basis for modeling comes from 1960-2016, meaning it does not account for potential future effects of climate change, nor does it include data from two years (2018 and 2020) in which lake discharges contributed to explosive algae blooms. This latter omission was of particular concern to P3, the director of an environmental nonprofit based on Florida's East Coast; she criticized the Corps' model of algae bloom risk as "not seem[ing] to be based in the real world" and further, argued for modeling that prioritized public health—a category she said ought to include not only risk of a dike breach, but also of algae outbreaks. Meanwhile, P12, a representative of the Seminole Tribe of Florida, a sovereign nation, complained that the Tribe's water use rights were modeled in the same way as users whose water use rights are governed by the state of Florida; if this simplification were codified in the final manual, in times of water scarcity, the Tribe might not receive water to which it is entitled under federal law. P4 and P7, scientists representing West Coast communities, expressed concern that when they dug into data on schedule CC—the draft plan the Corps later selected as the basis for the final manual—they found several instances of stressful flows to the western estuary; these outlier events had been obscured by the use of measures of central tendency. These stakeholders' concerns all illustrate that even complex models are simplifications, and that both the models' complexity and the simplifying assumptions and choices they encompass can invisibilize dynamics with significant implications for lives and livelihoods.

Although stakeholders mostly commended the Corps for its transparency and inclusivity, another concern they raised was the presence of subjectivity within the models, especially regarding the ways in which models weighted different objectives and community needs (P2, P6, P8, P12). These concerns were exacerbated by the fact that to engage with these complex models, stakeholders needed some degree of technical knowledge—or funding to hire one or more consultants to represent their interests. Anticipating this, the Corps spent a great deal of time explaining the models in the public workshops; they viewed the agency as having an important role to play as a "translator" of scientific information for people and communities that lacked capacity or technical know-how to readily participate in modeling (P10). As P9 put it, "We try to be the honest broker. We don't want to just serve the community that has the most money to hire the best consultants." However, comments by members of the general public who were unable to regularly attend these workshops suggest many nonetheless struggled to understand exactly what was going on within the "black boxes" of modeling (Field notes, 15 July 2021).

Real and perceived power differences among the various South Florida communities also exacerbated concerns about models' subjectivity. For instance, representatives of tribal communities (P2, P12) worried their voices would be drowned out by communities with larger populations, which contribute more money to Florida's economy and have greater political power. Representatives of east coast communities (P6, P8) voiced dismay that the complete elimination of discharges to the St. Lucie estuary is not under consideration; in the eyes of other stakeholders and water managers, this would benefit the East Coast disproportionately, to the significant detriment of other communities. A quote from P2, a representative of the Miccosukee Tribe, indicates how quantification exacerbates subjectivity-related concerns:

> There's this weighting, meaning they may assign, say, 15 percent to this category and 40 percent to this category. Clearly there's subjective values that are going in, and then at the end, it is presented as a computerized marvel that is, you know, scientific. It started subjective. How can it be scientific?

In response to these kinds of concerns, Corps staff said they have strived to be transparent about subjectivity and uncertainty within models; this is supported by their numerous, lengthy public workshops on modeling and metrics, which usually featured detailed presentations from Corps staff on technicalities of modeling, as well as extensive public comment periods and Q-and-A sessions between stakeholders and the Corps staff responsible for modeling (Field notes, 14 June 2021; 22 June 2021; 12 July 2021; 19 July 2021). Moreover, after announcing the decision to move forward with the schedule called Alternative CC, the Corps has continued to solicit public input on potential refinements, and plans to assemble subteams of stakeholders to work on operational guidance—language in the manual that will give water managers flexibility to use discretion, not merely an operational decision tree, in making water management decisions (U.S. Army Corps of Engineers, 2021c). Nonetheless, many stakeholders remain uneasy. When asked whether they think the final schedule will be fair, no stakeholder answered in the affirmative. Four stakeholders (P3, P4, P8, P12) expressed hope but not certainty. Two stakeholders (P2, P6) said they thought a "fair" or "balanced" outcome did not exist; two others said that "fair" is subjective (P4, P6). P7 said she thought the outcome would be better, although still not necessarily fair, if workshops had taken place in person so that stakeholders could develop bonds with one another through communication outside of formal meeting activities. Her concern about the effect of stakeholders' relationships on the manual development process is a focus of the next section. In it, I examine how stakeholders' unease stems not only from concerns about manual development procedures and the invisibilizations of modeling, but also from a public outreach process that led to tensions around the idea of a "balanced" management plan.

## Public outreach: "Balance" generates tensions

In the introduction to this article, I discussed one of the tradeoffs inherent in lake management: between holding lake levels high (which raises flood risk for communities south of the lake) or releasing water from the lake (which creates risk of algae blooms and salinity imbalances for communities on the coasts). There is also a tradeoff between maintaining water supply for tribal communities, farmers and lower east coast cities, or reducing environmental, economic and health risks to communities along the beleaguered eastern and western estuaries (U.S. Army Corps of Engineers, 2021b; P5). Additionally, several proposed plans that benefit recreation and navigability likely increase the risk of algae blooms on both coasts (U.S. Army Corps of Engineers, 2021b; P5). And, the tradeoffs are not merely among human communities: Making progress toward restoration of wetlands south of the lake would potentially increase harm to the lake itself (U.S. Army Corps of Engineers, 2021b). Water management in Florida has always entailed these kinds of tradeoffs: between the human world and non-human biomes; among marginalized communities and politically and economically dominant ones; and among multiple dominant human communities. In recent decades, massive population growth, development, environmental degradation and climate change have increased the frequency and intensity of such tradeoffs. But what makes the development of the new Lake Okeechobee manual particularly interesting is that in its public outreach, the Army Corps intentionally drew attention to these tradeoffs. Here I discuss how, why and the tensions that resulted.

*A "balance of balances" creates tension for the Corps*

In the spring and summer of 2021, the Army Corps hosted about a dozen virtual public workshops as part of an iterative process of presenting different potential lake management plans, receiving stakeholder feedback, and incorporating that feedback into revised potential plans. At these meetings, and in interviews that followed, it became clear that water managers—both the Army Corps and the South Florida Water Management District, the Corps' state-level partner agency—use "balance" in two ways: first, to connote individual stakeholders' perspectives, and second, to describe an equilibrium for the group as a whole (P9, P10, P11, P13). When asked about the latter, agency staff said their idea of balance centered on fairness, namely across Congressionally authorized project purposes (P11, P13) and geographic areas (P11). Additionally, two agency participants (P9, P10) defined balance in terms of what it is not: it is not making one stakeholder group happy, to the detriment of others.

When I asked stakeholders to provide their own definitions, their responses reflected these same two ideas: "balance" as an individual concern and "balance" among the group as a whole. Two stakeholders said balance meant prioritizing the unique risks faced by their communities, e.g. that balance should center on the environment (P1) or public health (P3), and all other needs should come after that. But for most stakeholders, "balance" was relational and entwined with a notion of fairness, be it sharing adversity (P2, P5), not favoring any one stakeholder over others (P7, P12), or allocating harm in proportion to benefits received (P8). Stakeholders who defined balance in terms of reducing the historic harms of water management to specific geographic areas (P4, P6, P8) discussed balance both in terms of their individual needs and to connote what they believed to be a "fair" equilibrium for the group as a whole.

The fact that both agencies and their stakeholders defined "balance" in the same way directly pertains to the tension between rationality and democracy and whether it is possible to reconcile the two. Theories of "governmentality" (Foucault, 1978; Rose and Miller, 1990), "governing at a distance" (Latour, 1987; qtd. in Miller and Rose, 1990: 2) and "the rule of experts" (Mitchell, 2002; see also Li, 2007) suggest the reason for this alignment might be that stakeholders were influenced by the Corps' framing of lake management as a problem of "balancing balances." However, work by scholars of "the third wave", especially Reichmann (2013) and Nowotny (2003) suggests agency staff's framing of the problem could have emerged inductively from stakeholders' concerns. Unfortunately, because my research process began well after the Corps had started public outreach, it is difficult

to judge which explanation is correct. Further, given the iterative nature of the manual development process, it may be a combination of the two.

That said, it is also significant that although agency staff and stakeholders gave the same definition of "balance", many members of each group believed the other's definition was different. In particular, when asked in interviews what they thought "balance" meant to the Army Corps, several stakeholders spoke about how they thought the Corps' priorities contrasted with their own (P2, P3, P8), possibly as a result of political pressures (P12). Another common response was uncertainty, that they didn't know what the Corps meant by "balance" (P1, P4, P7). Four stakeholders said that in the Corps' view, "balance" meant different things to different people (P4, P5, P6, P7); additionally, many stakeholders' responses were accompanied by a sense of vexation. As P4, a scientist representing several West Coast communities, put it:

> I have no idea what they [the Army Corps] mean. … They keep saying that balance means different things to different people. … That doesn't really get us anywhere. I mean, if you want a quote-unquote "balanced plan", then you have to agree on a definition of balance.

Most strikingly, however, no stakeholder said they believed the Corps defined balance as being a "fair" outcome. This is despite the fact that most stakeholders and all Corps staff expressed a preference that the Lake Okeechobee manual be fair, above all. Instead, several stakeholders (P2, P6, P7) said they did not believe a "fair" or "balanced" schedule exists; others (P4, P6) said they believed "fair" is subjective. In the next section, I examine how these views reinforced a fundamental unease among stakeholders, a belief communities were being pitted against one another, and the significance of this belief.

*Talk of tradeoffs catalyzes "water war" fears*

As previously discussed, several stakeholders commended the Corps for an engaging and transparent public outreach process. However, stakeholders overwhelmingly had a common complaint: that the Corps' focus on tradeoffs positioned communities as rivals. Seven of nine stakeholders interviewed (P1, P2, P5, P6, P7, P8, P12) either explicitly said they felt communities were being pitted against one another or gave examples of how they felt the Corps' discussion of tradeoffs had divided communities. Three interview participants (P1, P2, P6) said the first iteration of modeling contributed to this feeling, since each model in this stage maximized benefits for one objective to the detriment of others. P2 memorably said this made him feel South Florida was in "a water war". Meanwhile, P5, a scientist at an environmental nonprofit, and P12, a representative of the Seminole Tribe, described developing a "balanced" lake management plan in terms that evoked the prisoner's dilemma. As P12 put it, "[The Tribe] is not interested in sacrificing for the greater good when other people aren't. And I think that's the challenge we all face here."

Conversations with Army Corps staff suggest the goal of outreach was not to generate unease; however, the unease participants felt may be a sign the outreach efforts had their intended effect. Specifically, all three Corps staff interviewed (P9, P10, P11) said a main goal of outreach was to provide stakeholders a uniform understanding of the overall ecosystem and the tradeoffs of attempting water management within it, in the hopes of ensuring that whatever final outcome was reached would be acceptable to more people. Moreover, Corps staff emphasized the importance of stakeholders' recognizing that water management entailed tradeoffs. As P9, a Corps planner, put it:

> I would say for about a year and a half, we went through and talked about trade-offs a lot… just, you know, if you manage a plan to just do this one thing, this is what happens to these other things. And we had so many different workshops, so many different sub-team meetings, the entire iteration one evaluation was about the tradeoffs… I'm hoping a lot of people remember that, as we continue to go through the process and… when we talk about what's reasonable and what's realistic.

There are two ways of interpreting the Corps' focus on tradeoffs and implicit framing of lake management as a zero-sum game. First, there is the view through a lens of Foucauldian governmentality. This suggests the Corps' modeling and outreach efforts are a way of governing expectations, depoliticizing politics (Porter, 1995; Nelson Espeland and Mennicken, 2019) and controlling the ultimate outcome through "action at a distance" (Latour, 1987; qtd. in Miller and Rose, 1990: 2). In this view, the Corps' focus on tradeoffs frames the problem in a way that invites some specific solution driven by the technical experts who are endowed with authority (Li, 2007 on "rendering technical" and Mitchell, 2002 on "the rule of experts"). Modeling and public outreach are strategically deployed to build trust in the experts' decision-making (Porter, 1995). A comment from P6, who said she thought the Corps was doing outreach primarily to comply with federal requirements for environmental review under the National Environmental Policy Act, supports this perspective. However, participants' generally positive impressions of the Corps' outreach process (P1, P3, P4, P6, P8, P12), as well as the fact that the Corps deliberately facilitated stakeholders' understanding of tradeoffs and cultivated a baseline view of water management as a zero-sum game, suggest this is not the correct interpretation. If the Corps' primary goal were to build trust in its experts and processes of rationalization, why would it center an understanding of the lake that continuously generated tension between the agency and its stakeholders, and among stakeholder groups? Why would agency staff intentionally frame the problem in a way that encouraged unease and uncertainty about the final outcome?

A better explanation is the "third wave" view, that the Corps is indeed seeking to balance among competing and often conflicting interests, who have different needs and priorities, different amounts of power, and different capacities to participate in the lake management process. In this view, the Corps is in a similar position to Reichmann's (2013) economic forecasters, who must try to reconcile competing and, at times, conflicting, worldviews into one, unified whole. The differing notions of "balance" evoke Haraway's ideas of "situated knowledge"; the Corps' attempts to combine multiple "balances" into one equilibrium reflect her argument for "the joining of partial views and halting voices into a collective subject position" (1988: 590). The Corps' efforts also align with Nowotny's three criteria for socially robust knowledge. First, the diverse scientific and lay stakeholders who participated in the outreach process constitute "an extended group of experts, of real or symbolic users and of real or 'imagined' lay persons" (2003: 154). Second, through measures such as having stakeholders contribute to the development of key performance indicators and operational guidance (U.S. Army Corps of Engineers, 2021c), the Corps' management effort has been and continues to be tested for validity "outside the laboratory, in a world in which social, economic, cultural and political factors shape the products and processes resulting from scientific and technological innovation" (2003: 153). Finally, the continually iterative nature of the Corps' outreach process, in which technical modeling is opened to public scrutiny and the manual is developed and refined based on stakeholder concerns, suggests that the Corps' effort is indeed "open to continuous social monitoring, testing and adaptations" (Nowotny, 2003: 154). Thus, although the Corps' process contains some procedural limitations to democracy (e.g. P2's concerns about limited staffing for participation, P7's worries about a lack of time to thoroughly analyze the models), and at times invisibilizes simplification and subjectivity in rational modeling process, the effort ultimately demonstrates how rationality and democracy may be combined to co-produce transparent and inclusive environmental risk management strategies.

## The value of unease for catalyzing collective action

My analysis has been an act of what Reichmann (2013: 869) calls "Rundrechnung" or "round-calculation"—the smoothing away of inconsistent worldviews to develop a unified whole. It is an act of rationalizing democracy; and although in the future it could be re-democratized by soliciting revisions from research participants, for the time being, it is limited to the narrative I have developed. Although I have attempted to be rigorous and reflexive in my research process and analysis, the conclusion I reached in the previous section remains unsatisfactory. Specifically, concluding that Corps staff are doing their

best to create a transparent and inclusive manual leaves unaddressed the unease and uncertainty that many stakeholders (P2, P4, P5, P6, P7, P8, P12) expressed about the outcome, especially when asked if they believe it will be fair. So, before closing this analysis, I would like to highlight a certainty that holds regardless of the reader's view on whether the outreach process and, ultimately, the lake manual, successfully brought together rationality and democracy to create a transparent and inclusive solution. The certainty is this: All current options for lake management entail distribution of risk and loss, either as major risks and losses allocated to a few stakeholders or as smaller risks and losses apportioned among many. This insight is a potential basis for collective action, in two ways. First, agency staff (P9, P10, P11, P13) and several stakeholders (P2, P6, P7, P12) alike expressed hope that if all communities with something to lose in the management of Lake Okeechobee understand that all other communities have something to lose, as well, then there will be a better chance that everyone voluntarily agrees to make some amount of individual sacrifice for the betterment of the group as a whole. Second, the tradeoffs brought to light by the Lake Okeechobee manual process exist because the Everglades ecosystem has been replumbed, populated and degraded in such a way that it cannot support South Florida's human and non-human communities without also exposing them to risk and loss. For a large and diverse group of stakeholders, the Corps' outreach process has highlighted this reality; as a result, the process may help to generate additional support for comprehensive Everglades restoration, the goal of which is to restore a more natural flow of water and reduce nutrient pollution, while also ensuring "a healthy and sustainable natural and human environment" (U.S. Army Corps of Engineers, 2018). While it may be impossible to restore the Everglades to its original state, the Lake Okeechobee manual development process and similar efforts help illuminate how many, perhaps most, constraints on "balanced" risk distribution are fundamentally anthropogenic. By acknowledging humans' role in creating these constraints, and by engaging with the risks and losses they impose on human communities and nonhuman biomes, it also becomes possible, in Cronon's words, to make decisions that confirm an ethical, sustainable, and honorable human place in nature (1996:17)—and in relation to one another.

## Conclusion

As is true of most hearts, Lake Okeechobee is both a source of life and a source of brokenness: it supports farming and fishing, an array of wetland and subtropical wildlife, and the Indigenous communities who called the Everglades home before Florida existed. But it also causes economic and ecological pain to communities on Florida's east and west coasts who receive discharges of its nutrient-heavy water, which can catalyze toxic blue-green algae blooms. And, once immortalized as "the monstropolous beast" (Hurston, 1937: 161) that surged over its dike to kill more than 2500 people, the lake is believed capable of killing again. By draining the Everglades, and urbanizing, developing and farming in close proximity, humans increased Lake Okeechobee's power; today, in addition to being a heart, the lake is a hegemon: it forces humans to attempt to manage it in order to protect against risk and potential loss. My research examines the Army Corps' efforts to develop a management manual that is unified and internally consistent, but also encompasses conflicting needs and priorities of Lake Okeechobee's many stakeholders.

I began this analysis with a literature review that examined the tensions between democracy and rationality, and the promise and perils of each as a basis for decision-making in ecosystem risk management. Acknowledging my prior experience as a former Florida environmental journalist and local government employee, I then laid out the process I undertook to ensure both reflexivity and methodological rigor in interviewing 13 stakeholders and agency staff about the Lake Okeechobee System Operating Manual (LOSOM). Subsequently, I analyzed how Army Corps environmental risk managers combined rationalization and expertise democratization to develop a lake management schedule that attempts to balance the concerns, often conflicting, of stakeholders whose lives and livelihoods are entwined with Lake Okeechobee. In this analysis, I first drew attention to barriers to participation in the modeling process, as well as some of the invisibilizations of the Corps' water management models. Next, I examined how discussion of "balance"

illustrated tradeoffs and generated tensions between stakeholders and the Corps, and among stakeholder communities. Drawing on literature on governmentality and from "the third wave" (Collins and Evans, 2002) of science and technology studies, I argued that although the Corps' manual development process entailed some procedural injustices and invisibilizations, it fundamentally demonstrates that rationality and democracy may be brought together to increase the transparency and inclusivity of environmental risk management efforts. Finally, I highlighted the lingering unease around the manual outcome as a potential starting point for collective action in support of a comprehensive restoration plan that could reduce the need for tradeoffs.

My analysis has largely treated the Lake Okeechobee manual as static; I have not attempted to investigate how future beliefs and evolving expectations about factors including ongoing ecosystem restoration/degradation, population growth, and climate change influence the positions of stakeholders or agency staff. This is a potentially fruitful area of future inquiry, as is the question of whether the manual will indeed catalyze collective action for restoration. For now, in light of the complex, interconnected and ever-increasing risks and injustices of the Anthropocene, my hope is that this case encourages both environmental risk management that prioritizes equity, and additional research that investigates the ways in which humans attempt to allocate—and ultimately, alleviate—risk, suffering and loss. Or, as Haraway (1988) and Cronon (1996) might put it, if they ever worked together: It is by acknowledging the partiality of our perspectives that humanity can arrive at equitable and honorable responses to environmental risks.

## Acknowledgements

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